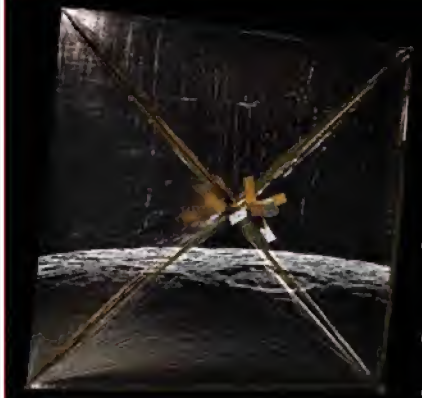

Lunar Flashlight

Mapping lunar surface volatiles using a cubesat

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- The Lunar Flashlight mission will identify lunar surface ice deposits and map favorable locations for in-situ utilization
- In development and scheduled for launch on SLS EM-1 (NET December 2017)
- Sponsored by NASA HEOMD Advanced Exploration Systems to address Strategic Knowledge Gaps in understanding water and other volatiles in lunar polar regions

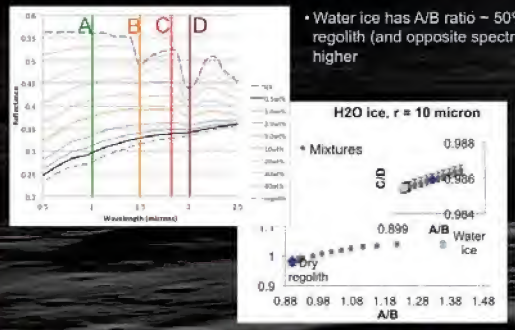
Lunar Flashlight identifies and maps lunar surface volatile deposits

Locations where Diviner measures the coldest year-round temperatures (Paige et al. 2010) also have high albedo measured by LOLA at 1.064 μm (Zuber et al. 2012) and by LAMP in UV (Gladstone et al., 2012), data consistent with water frost on the surface. Exposed water frost could be potentially useful to future human explorers.

Objective 1 (measurement): LF shall measure the abundance of lunar volatiles present at levels ≥0.5 wt% in the lunar regolith with a precision of ±50% or better

Reflectance spectroscopy is the standard technique for identifying molecular "fingerprints" from a distance

LF measures H_2O absorption bands and continuum to derive ice abundance

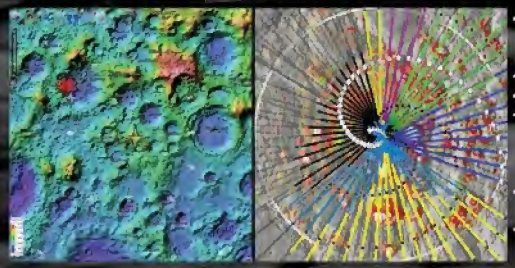


- Water ice has A/B ratio ~ 50% higher than dry regolith (and opposite spectral slope), C/D ~ 5% higher
- Baseline instrument and mission design yield detections easily within the 0.5% (by mass) water content threshold (Error bars indicate 1σ uncertainty for single measurement)
- Potential to separate H_2O ice from CO_2 ice, which will aid understanding origins and distribution of H-bearing volatiles useful as resources

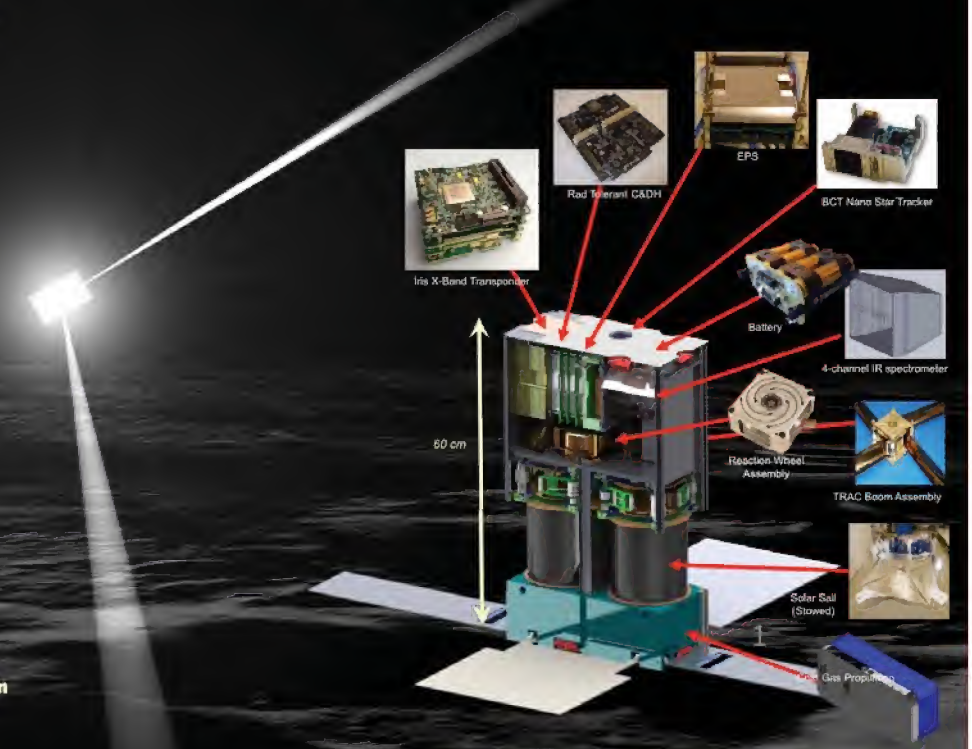
Objective 2 (mapping): LF shall map the distribution of exposed water ice with 1-2 km resolution within the permanently shadowed regions at the lunar south pole

This is an operationally useful scale for future landers and rovers

Enables prediction of other ice deposits by correlating data with other mapped geologic characteristics, including latitude, temperature, topography, lighting, proximity to young fresh craters, etc.



- All ground tracks are the same length (10 degrees latitude around pole), with varying width (spot size).
- Initial Orbit: 9000 x 200 km
- Spiral down to 9000 x <20 km
- Distance to surface varies with latitude and orbit perilune. Spot size on the surface depends on distance from S/C to the surface.
- 10% of PSRs within 10° of pole are observed (60 orbits), covers Shoemaker Crater and LCROSS site
- ~50% of observations will have 1-km footprint; >95% will be 2 km



Lunar Flashlight demonstrates a low cost capability for lunar measurements

- Bus: JPL 6U Deep Space NanoSat, <11.4 kg (leveraging INSPIRE)
- Propulsion: MSFC ~80 m² Solar Sail (based on NanoSail-D) with cold gas supplement
- Payload: COTS 4-band spectrometer
- C&DH: Rad Tolerant LEON-3 architecture, JPL Protos FSW
- ADCS: COTS Cold Gas, RWA, SRU, IMU, CSS
- Power: ~44W
- Telecom: JPL Iris X-Band Transponder + Patch Antenna (~1 kbps nominal @ Lunar Distance with DSN State)
- 18 mo nominal mission (30 mo max lifetime)